

**MISSOURI DEPARTMENT OF NATURAL RESOURCES  
AIR AND LAND PROTECTION DIVISION  
ENVIRONMENTAL SERVICES PROGRAM  
Standard Operating Procedures**

SOP #: MDNR-FSS-009 EFFECTIVE DATE: 03/31/04

SOP TITLE: Collection of Samples from Tanks

WRITTEN BY: Larry Alderson, Environmental Specialist, EER/Field Services Section, ESP

APPROVED BY: Earl Pabst, Director, ESP

SUMMARY OF REVISIONS: Revisions made to conform to division and program reorganization


APPLICABILITY: Applies to the sampling of tanks by personnel in the Environmental  
Emergency Response/Field Services Section of the Environmental  
Services Program


DISTRIBUTION: MDNR Intranet  
ESP SOP Coordinator


RECERTIFICATION RECORD:

Date Reviewed				
Initials				

## 1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) provides technical guidance for collecting representative samples of materials contained in tanks and describes safe and effective techniques that may be used. Investigations involving tanks will generally be at the request of the Hazardous Waste Program (HWP) or as directed by the On-Scene Coordinator (OSC) during a spill cleanup or incident response. This document is written for ESP field staff who are properly trained and equipped to conduct hazardous waste site investigations and who participate in the Department's medical monitoring program. This SOP will assist the sample collector in developing both a sampling plan and a health and safety plan for tank investigations.

The procedures contained in this document are applicable to the collection of samples from tanks by Environmental Emergency Response/Field Services Section (EER/FSS) personnel of the Environmental Services Program.

## 2.0 SUMMARY OF METHOD

The collection of representative samples of materials from storage tanks can potentially present a number of problems that can be both dangerous and challenging. Tank investigations may involve unknown materials and may not be easily accessible. The procedures described within this SOP provide guidance on conducting an initial site survey and making a decision on the best method for sample collection. The procedures include recommendations for site screening instrumentation and the use of personal protective equipment. The various types of tanks and methods of access are described. Sampling equipment and procedures are also discussed. A particular emphasis has been placed upon health and safety issues as they relate to each of the procedures described within this SOP.

## 3.0 DEFINITIONS AND ACRONYMS

- APR - Air Purifying Respirator
- ASTs and USTs - Above ground and Underground Storage Tanks
- Buddy System - A safety system where each person works directly with another, or a "buddy", in a two-person team. Each person in a team should always maintain visual contact with his/her partner, with an emphasis on always being aware of each other's whereabouts in the event an accident or problem should occur.
- Coliwasa - a sampling device that allows for the collection of various phased liquid samples.
- HASP - Health and Safety Plan
- HSERP - Hazardous Substance Emergency Response Plan

- Manway - An opening in a tank that is of sufficient size to allow a man to enter for inspection or cleaning. NOTE: See Health and Safety Warnings, section 4.3.
- PID (Photoionization Detector) - A portable air monitoring instrument used to measure the amount of ionizable organic vapors present.
- PPE - Personal Protective Equipment
- Safety Officer - The person assigned as the health and safety officer or the FSS/EERS project manager.
- SCBA - Self-Contained Breathing Apparatus
- Tank - Any large container, usually 100 gallons or more, that is designed to contain or store a liquid material under normal atmospheric pressure. Pressurized tanks or cylinders will not be sampled by ESP personnel and are not included in this SOP.
- Thief tube - A hollow glass tube, normally four-foot in length, that comes in various diameters and used to collect a liquid sample from drums or tanks.

#### 4.0 HEALTH AND SAFETY WARNINGS

The health and safety warnings described below are not listed in any particular order and should all be considered when conducting a tank investigation.

- 4.1 The "buddy system" should always be used during a tank investigation.
- 4.2 The level of personal protection required for opening tanks and collecting samples shall be described in the site specific HASP and must be discussed in the site safety briefing. In general, level B protection is required for opening tanks containing unknown materials. If personal protection greater than level B is required, based upon preliminary information gathered about the contents, then ESP personnel shall not conduct the sampling and shall contact a qualified hazardous materials contractor to complete the work. The level of protection may be lowered if the material in the tanks is known to be a low hazard risk.
- 4.3 Tanks are considered to be confined space. ESP personnel are neither trained nor equipped for confined space entry. If the tank must be entered, a qualified contractor should be contacted to conduct the sampling.
- 4.4 Because tanks often contain flammable liquids, spark-resistant tools should be used to open manways, vents, or fill ports, and grounding measures should be taken to prevent static discharge. (NOTE: A stainless steel bucket with a wire and clamp to attach to the tank can be used to transport sampling equipment to the tank opening.) Ideally, all electronic instruments used during a tank investigation should be rated as intrinsically-safe (i.e. equipment that is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration). Pagers, cellular phones,

radios, and other equipment not rated as intrinsically-safe MUST NOT be in the work zone when flammable liquids are suspected. An explosimeter should be used to monitor a work zone to assure that explosive levels do not reach levels of concern (i.e. > 10% LEL).

- 4.5 Unless the contents of a tank are known, samples collected should always be considered hazardous substances and should not be chemically preserved due to the potential for a severe reaction. All samples should be preserved on ice as soon as collected and packed in a cooler in such a manner to prevent container breakage.
- 4.6 Prior to opening a tank, sampling personnel should visually inspect the condition of the tank looking for evidence of any corrosion, damage, leakage, and excessive internal pressure such as swelling. Any markings, placards, or other written information should be read and assessed to help determine the possible contents of the tank. However, any information learned from markings or placards may not be accurate and should always be considered suspect.
- 4.7 Extreme caution should be used when attempting to open any tank, especially if it appears swollen or under pressure. A full tank or one that may be under pressure due to high ambient temperatures can spew liquid contents if the valve or opening is not opened slowly.
- 4.8 Personnel should be very careful standing or walking on tanks that are not equipped with walkways and guard rails, due to the danger of collapse, breakthrough, or slippage.
- 4.9 Tanks or cylinders with rounded ends, that are designed for contents under pressure, will not be sampled by ESP staff, due to the extreme hazard associated with pressurized tanks.
- 4.10 Because of the need to wear level B or C personal protective equipment, adverse weather conditions (i.e. extreme cold or hot and humid weather) must be considered when deciding whether or not a tank investigation should be conducted. If possible, tank investigations should be conducted when the weather is relatively mild and the risk of frostbite or heat stress is either minimal or non-existent. If working in extreme weather conditions cannot be avoided then the site specific HASP must address the weather conditions and describe specific procedures to monitor and protect site workers from suffering cold or heat related illnesses.
- 4.11 For any sampling investigation that occurs at a hazardous waste site, site specific health and safety requirements should be described in a written HASP. A site safety meeting should be held by the person in charge of the sampling investigation and should take place in the field prior to conducting any fieldwork. All sampling personnel directly

involved in the fieldwork should read and sign the HASP. The HASP should be kept in the field in a location readily available to all field personnel.

## 5.0 PERSONNEL QUALIFICATIONS

All ESP personnel directly involved in field investigations at sites that fall under the EPA Worker Protection requirements of 40 CFR Part 311, referencing OSHA 29 CFR Part 1910.120, and meet the definition of HAZWOPER activities must meet the following qualifications. Most tank investigations will meet the definition of HAZWOPER site work. Under OSHA 29 CFR Part 1910.120 and ESP policy personnel must:

- attend a 40-hour course designed to meet the OSHA health and safety training requirements for hazardous site workers;
- attend an annual 8-hour health and safety refresher course, or receive equivalent training;
- participate in a medical monitoring program in accordance with department policies;
- receive appropriate on-the-job training;
- be familiar with the *Hazardous Substance Emergency Response Plan (HSERP)*, written and maintained by the ESP; and
- be familiar with the ESP SOP manual and have read all SOP documents that are applicable to the field activities, including but not limited to those referenced in this SOP.

## 6.0 SUPPLIES AND EQUIPMENT

The following supplies and equipment will likely be needed to safely assess the hazards at a tank site and collect samples from tanks for field or laboratory analyses. Some of the equipment and supplies listed (e.g. flash point tester) are optional, depending upon the specific purpose and data needs of the particular investigation.

- radiation meter
- PID
- explosimeter
- glass thief tubes
- Coliwasa
- spoons or trowels
- wide-mouth glass sample jars with Teflon-lined lids
- heavy duty ziplock bags (for packaging and storage of filled sample containers)
- paper towels
- sample labels (pre-numbered and blank)
- cooler(s) with ice
- field notebook
- Field Sheet and Chain-of-Custody Record Forms

- Level B personal protective equipment
- Level C personal protective equipment (in case downgrading is determined to be safe)
- decontamination supplies for both personnel and equipment
- camera and film or digital camera
- pH meter and/or pH paper for field analysis
- Setaflash flash point tester for field analysis
- zone or bomb samplers
- bailers
- rope or cord
- stainless steel buckets
- trash bags

## 7.0 PROCEDURE

### 7.1 Preliminary Fieldwork

- 7.1.1 Upon arrival at the tank site, a site safety meeting should be held and attended by all staff who will be directly involved in the tank investigation. The site specific HASP shall be discussed. Each member of the investigation team shall read and sign the HASP. The HASP shall then be placed in an area on-site where it is readily accessible to site workers.
- 7.1.2 The level of personal protection required for conducting preliminary fieldwork shall be described in the site specific HASP and must be discussed in the site safety briefing. In general, level D should be adequate protection for conducting preliminary fieldwork as long as tanks are not open or leaking, and there are no other hazardous site conditions that would warrant upgrading to a higher level of personal protection.
- 7.1.3 All field instruments shall be calibrated prior to use in accordance with the manufacturers' instructions and any applicable ESP Standard Operating Procedures.
- 7.1.4 An initial site survey should be conducted prior to opening any tanks. The initial site survey should include a visual inspection of the tanks for evidence of corrosion, leakage, or significant damage. The type of openings should be noted to determine the best access that will allow the safe collection of a representative sample.
- 7.1.5 All activities shall be documented in a field notebook according to procedures outlined in MDNR-FSS-004 *Field Documentation*.

## 7.2 Sample Collection

- 7.2.1 A PID should be used to screen the headspace of a tank immediately upon opening and the values noted in the field notebook. The sampler may also choose to record PID values on a Chain-of-Custody document, especially if samples are being collected for laboratory analysis.
- 7.2.2 Before samples are collected, universal absorbent pillows should be placed around the manhole to protect the outside of the tank from any drips or spills.
- 7.2.3 Because of the variability in both the size and position of tanks and the physical state of the material contained within, a number of different methods may be employed to collect representative samples. Disposable glass thief tubes or Coliwasas may be used to collect samples in small tanks, where the total depth is limited to 4 to 6 feet. The thief tube can be inserted through a fill pipe or manway and lowered to the bottom of the tank. The opening at the top of the thief tube is covered tightly with a gloved thumb to create a vacuum that allows much of the liquid to be retained in the thief tube as it is withdrawn. Similarly the stopper at the end of a Coliwasa can be closed to contain the representative sample of the entire depth of the liquid in the tank. If a tank is very large or above ground and sitting vertically, a zone or bomb sampler may need to be used. With this type of sampler, several aliquots at various depths may be needed if there is potential for stratification of the material. The aliquots can be placed in a stainless steel bucket and thoroughly mixed prior to sampling. A disposable bailer may also be used if the material is known to be unstratified or if a non-representative grab sample is adequate for the data quality objectives.
- 7.2.4 The material makeup of the sampling device and the sample containers will be such that the sampling equipment and containers will not react with, add to, or subtract from the concentration of the parameters to be analyzed (see SOP MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times and Special Sampling Considerations*). Sampling equipment should be constructed of stainless steel, glass, polyethylene, or Teflon. A nylon delivery line can be used when it is necessary to lower samplers into a liquid. The standard sample containers used for product or hazardous waste samples are glass jars equipped with Teflon lined lids.
- 7.2.5 If a tank contains sludge or other solid materials, equipment such as spoons, augers, or core samplers may be used to obtain a sample. Collecting a true representative sample from a tank containing a solid material may not be possible under normal field conditions without entering the tank, depending on it's size and position. Again, if entering a tank is required, a contractor who is certified for confined space entry must be obtained.

- 7.2.6 As soon as possible after collection, the sample containers must be labeled and placed on ice in a cooler. Refer to MDNR-FSS-003 *Sample Numbering and Labeling* for more information. Because the outside of sample jars may become contaminated with the sampled material, it may be necessary to wipe the outside of the jars with paper towels and place the jars in plastic bags before putting them into the cooler.
- 7.2.7 The sample collector must complete a Field Sheet and Chain-of Custody Record as soon as possible after collection. Refer to MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record* for information on completing this important piece of documentation.

### 7.3 Decontamination and Disposal

- 7.3.1 Whenever possible, sampling personnel should take enough equipment into the field to eliminate the need for field decontamination. If field decontamination is necessary, refer to MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*. Additional decontamination procedures may also be described in a site specific sampling plan or HASP.
- 7.3.2 Contaminated disposable sampling equipment (e.g. PPE, thief tubes, or spoons) shall be returned to the ESP laboratory in Jefferson City for proper disposal. The contaminated thief tubes, as with other contaminated disposable sampling equipment, should be bagged and returned to the ESP for proper disposal. Contaminated non-disposable equipment should be bagged and returned to the ESP for proper decontamination.

## 8.0 HANDLING AND PRESERVATION

- 8.1 Unless the contents of a tank are known, samples collected should always be considered hazardous waste samples and, as such, should not be chemically preserved due to the potential for a severe reaction between the waste sample and the chemical preservative. Samples should be preserved on ice as soon as collected and should be packed in a cooler in such a manner to prevent container breakage.
- 8.2 If the substance collected from a tank is a water sample, not considered a concentrated hazardous material or product sample (e.g. oil or caustic material) and not expected to react with a chemical preservative, then the sample collector should follow the guidance specified in Table I of MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* in the selection of



sample containers and use of chemical preservatives. If there is any question that the sample does not meet all of the criteria listed above, then the sample collector should err on the side of caution and not add any chemical preservative to the sample. Note: all waste preservative ampules should be properly disposed with other contaminated disposable sampling equipment.

- 8.3 If both water samples and concentrated waste samples are collected during a tank investigation, then the water samples should be placed in one cooler while the concentrated waste samples are placed in another to prevent cross contamination while in the field and during transportation. If a trip blank has also been collected, it should be placed in the same cooler as the water samples.
- 8.4 For further guidance on sample handling procedures, refer to Standard Operating Procedure MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL (QAQC)

The type and frequency of field QA/QC samples needed at any given site are generally covered by a Quality Assurance Project Plan or a site specific sampling plan. Some of the different types of field QA/QC samples that may typically be collected during a tank investigation are listed below, with general recommendations on when they may be appropriate. MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection* provides further guidance on QA/QC sampling procedures.

### 9.1 Trip Blank

- 9.1.1 If a water sample for volatile organics analysis is collected during a tank investigation then a trip blank sample should also be collected.
- 9.1.2 A trip blank should consist of analyte-free water obtained from the Volatiles Lab within the ESP and preserved with HCl. A trip blank sample is never opened in the field.
- 9.1.3 A trip blank should be packed with the sample containers that will be used during the trip. Once water samples have been collected and placed on ice in a cooler, the trip blank should be put in the same cooler as the water samples.

## 9.2 Duplicate and Replicate (split) Samples

- 9.2.1 A duplicate is a sample obtained from the same location at essentially the same time as the true sample. The procedures and equipment used to collect both the true sample and the duplicate sample should be identical.
- 9.2.2 A replicate split sample is obtained by dividing or splitting one sample into two samples for separate analysis.
- 9.2.3 Either a duplicate or a replicate split sample should generally be collected for every ten true samples collected at a site.

## 10.0 REFERENCES

- MDNR-FSS-001 *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations*
- MDNR-FSS-002 *Field Sheet and Chain-of-Custody Record*
- MDNR-FSS-003 *Sample Numbering and Tagging*
- MDNR-FSS-004 *Field Documentation*
- MDNR-FSS-018 *Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab*
- MDNR-FSS-206 *Decontamination Procedures for Sampling Equipment*
- MDNR-FSS-210 *Quality Assurance/Quality Control for Environmental Data Collection*
- HSERP